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NOTES ON *FRAXINUS PROFUNDA* (OLEACEAE)

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ABSTRACT

A taxonomic overview is provided for *Fraxinus profunda* — including a nomenclatural summary with lectotypes designated for *F. profunda* and the synonymous *F. michauxii*, an updated morphological description including a comparison with *F. pennsylvanica*, and a county-level distribution map. Geographically disjunct records for *F. profunda* in distinctly inland localities (Mississippi and Alabama) are documented; far-inland records from Tennessee and North Carolina were based on collections of *F. biltmoreana*.

KEY WORDS: *Fraxinus profunda*, *F. michauxii*, *F. pennsylvanica*, Oleaceae

Fraxinus profunda occurs primarily along the Atlantic and Gulf coasts into peninsular Florida and in drainages of the Mississippi River and in the Ohio River basin (Little 1977; McCormac et al. 1995). At the northwestern corner of its range, it occurs in bottomlands of the Kankakee River (vPlants 2010), an Illinois/Mississippi River tributary. Limits of the northern range of the species (Michigan, Ontario) have recently been documented in detail (McCormac et al. 1995; Waldron et al. 1996). The trees consistently grow in river swamps and floodplains, especially those seasonally inundated, freshwater tidal wetlands, commonly with bald cypress, swamp cottonwood, and water tupelo. In Illinois, Indiana, Ohio, and northward, they often are found in wet woods and swampy depressions in upland woods as well as till plains and clay lake plains of post-glacial lake beds.

Based on the map from Little (1977), Harms (1990) noted that the range of *Fraxinus profunda* is "quite discontinuous," but addition of recent records shows a more continuous range (Fig. 1). The distribution is ringlike, the southern portion of its range close to the Gulf coast, turning northward along the Mississippi River and then eastward along the Ohio River drainage. Localities in the Carolinas extend inland but reported far-inland records from Tennessee (Marion Co.) and montane North Carolina (Ashe and Swain cos.) have been based on collections of *F. biltmoreana* Beadle. Scattered populations of bona fide *F. profunda* in Georgia (along the Savannah River), Alabama, and Mississippi are considerably inland.

ALABAMA. **Madison Co**.: Redstone Arsenal, ca 4 mi due S of Huntsville, Thiochol Pond, rare in water ca. 2 feet deep, 4 Jul 1980, *Haynes 7946* (NY, VDB); **Pickens Co**.: prairie [weeds] over limestone ca. 1 mi S of Cochrane, 5 Oct 1972, *Kral 48788* (VDB). **MISSISSIPPI**: **Lowndes Co**.: 2 mi S lof Mayhew Junction, Black Belt region, 10-15 m tree along slough, fruit inaccessible, 6 Jun 1970, *McDaniel 13477* (VDB).

Name of the species.

Fernald (1938, p. 451) noted that *Fraxinus profunda* "is so characteristic of the river-swamps and dismals in southeastern Virginia that it seemed improbable that it should have been overlooked by Michaux and other early collectors who went through the region. André Michaux and his son Francois André, it now seems clear, got it and the younger Michaux described and beautifully illustrated it, his plate showing the wholly characteristic foliage with slender petiolules and the quite distinct fruit."

Fraxinus tomentosa F.A. Michx., as the plant illustrated in Plate 9 of Michaux's "Histoire des Arbres Forestiers de l'Amerique," is clearly the species identified here as *F. profunda*. Michaux's description noted that it grows in frequently submerged habitats with other swamp species, including *Nyssa aquatica*. As directly implied by Britton (1905, 1908), however, Michaux's manner of presentation rendered the name *F. tomentosa* superfluous and illegitimate. "The species was illustrated by Michaux as *Fraxinus tomentosa* Marshall, but his accompanying description applies to *Fraxinus pennsylvanica* Marshall, and he cited *Fraxinus pubescens* Lamarck (which is the same as *F. pennsylvanica* Marshall) as a synonym" (Britton 1908, p. 804). "F.A. Michaux similarly changed several other names without justification in the same work" (Little 1952, p. 379). The description of *F. michauxii* Britton (Britton 1905) was intended to provide a valid name for *F. tomentosa* but by that time B.F. Bush already had recognized *Fraxinus profunda* at specific rank.

In North American Trees, Britton (1908) recognized both *Fraxinus michauxii* and *F. profunda*, apparently emphasizing differences in samara morphology (those of *F. michauxii* less compressed and at the lower range of length for the species, as treated here).

Bush (1897, p. 516) explained the origin of the common name. Along Cypress Creek near Varner, Arkansas (Lincoln Co.), where he found *Fraxinus profunda* in abundance, he noted that "My guide told me that the people in the neighborhood call *Fraxinus profunda* Pumpkin Ash on account of its being swell-butted, a character which I had already noted in the trees of Missouri. This Ash grows here to a height of one hundred feet, with a trunk eighteen inches in diameter, and is larger and better developed and more abundant than I have seen it elsewhere."

Fraxinus profunda (Bush) Bush, Gard. & Forest 10: 515. 1897. *Fraxinus americana* var. *profunda* Bush, Annual Rep. Missouri Bot. Gard. 5: 147. 1894. *Fraxinus pennsylvanica* var. *profunda* (Bush) Sudw., USDA Div. Forest Bull. 14: 329. 1897 [non Lingelsh. 1911; not A.E. Murray 1983]. *Calycomelia profunda* (Bush) Niewland, Amer. Midl. Nat. 3: 186. 1914. *Fraxinus pennsylvanica* subsp. *profunda* (Bush) A.E. Murray, Kalmia 13: 6. 1983. **LECTOTYPE**: (designated here): **USA**. Missouri. Dunklin Co.: no other data, 17 May 1892, *B.F. Bush s.n.* (MO!). The label is handwritten by Bush and has "n. sp." in the upper right corner. The sheet includes one complete leaf, the petiole plus rachis 26 cm long, and a packet with samaras.

Protologue: "Abundant in the swamps of Dunklin and New Madrid counties. Sept. So far as can be seen from his figure, the same as Wenzig's *F. platycarpa Floridana*, but it is possible that his figure is actually from young specimens of *platycarpa*. Differs from the usual form of *Americana* in the strong pubescence of the shoots, the large size of the leaves, and the very large fruit, the shaft of which is often strongly six-sided." *Fraxinus platycarpa* var. *floridana* Wenzig is interpreted here as a synonynm of *F. caroliniana* Mill.

Bush (1894) noted that he made several collecting trips to southeastern Missouri (Dunklin and New Madrid counties) to study the swamp flora —May 1892, October and November 1892, April 1893, July 1893, and September 1893 — and specimens of *Fraxinus profunda* at MO can be found for these dates. He observed (pp. 139–140) that "As I was working for the interest of the Missouri Botanical Garden only, I did not collect sets for distribution, but have since put up what duplicates I had left, in a few sets, at the suggestion of Dr. Trelease." Another of the duplicates is at NY!, shown on the NY web site as a potential type: Dunklin Co., 11 Sep 1893, *Bush 89*). The NY specimen is a single leaf, filling the sheet. Bush returned to the same area to collect in 1893, 1894, 1895, and 1897, and duplicates of these are at GH.

Fraxinus tomentosa A.F. Michaux, Hist. Arbr. Forest. 3: 112, pl. 9. 1813 [nom. superfl. illeg.]. **TYPE**: **USA**. "Amer. Sept.," no other information, *M. Michaux s.n.* (P presumably).

Fraxinus michauxii Britton, Man. Fl. N. States (ed. 2), 1075. 1905. **LECTOTYPE** (designated here): **USA**. New York. Bronx, North Meadows, New York Botanical Garden, 15 Jul 1903, *N.L. Britton s.n.* (NY 297191, digital image!; isolectotypes: NY-5 sheets, digital images!). The protologue noted only "Type specimen from a wild tree in the New York Botanical Garden." Britton later added (1908) that "Specimens which were taken as the type of this species were obtained from a wild tree in the north meadows of the New York Botanical Garden, July 2, 1903." All sheets of the "North Meadows" collection at NY are labeled "July 15, 1903;" the reference to "July 2" perhaps was a typographical error.

Six sheets at NY were labelled as isotypes by E.K. Schofield in 1979. Originally there appear to have been 7 duplicates, as there is an empty folder with the other six, noted as "7 of 7 sheets." The 7th sheet appears now to be in the general collection with a pencilled annotation as "merotype" and probably should be returned to the types.

The "North Meadows" of the Botanical Garden formerly included an area, still wooded, of the Bronx River floodplain that is now is part of the Bronx County park system. The tree of from which the type collection of *Fraxinus michauxii* was made has not been relocated and perhaps is dead (fide Michael Nee, NY), but several other large individuals, apparently native, still persist in the immediate area.

Morphology of the species.

Trees, 15–30(–40) m, often forming swollen or buttressed bases under flooded conditions; twigs terete; bark gray-brown, furrowed with blocky and often discontinuous, nearly parallel to reticulate ridges; winter buds brownish. **Leaves** deciduous, pinnate, 20–45 cm, leaflets (5–)7–9, dark green adaxially, paler abaxially, glabrous adaxially, not papillose, densely to sparsely villous-puberulent abaxially over whole surface, only along the midvein and laterals, or less commonly only along the midvein, scaly-punctate to smooth, blades (7–)9–15(–25) cm x (2.5–)3.5–7(–8, –11) cm, broadly lanceolate to ovate-lanceolate, broadly elliptic, or lanceolate-elliptic, apex acute to acuminate, base often rounded or less commonly obtuse to acute or acuminate, margins entire to obscurely serrate, lateral petiolules 5–12(–20) mm, narrowly winged; rachis(5–)8–15 cm; petiole bases not raised; leaf scars broadly obovate to shallowly hemispheric, apex shallowly concave to concave-notched. **Flowers** unisexual (species dioecious), appearing before leaves, wind pollinated; pistillate calyx present and persisting at base of samaras; petals absent. **Samaras** (35–)40–70(–75) mm, body plump and subcylindric to slightly flattened and shallowly channeled, wings 2, gradually expanded from near the base of the body to proximal 1/2, (5.5–)6–10(–12) mm wide. $2n = 138$.

Flowering (Mar–)Apr–May. River swamps and floodplains, especially those seasonally inundated, freshwater tidal wetlands, commonly with bald cypress, swamp cottonwood and water tupelo, wet woods, swampy depressions in upland woods, till plains, clay lake plains of post-glacial lake beds; 10–200 m; Ont.; Ala., Ark., Del., D.C., Fla., Ga., Ill., Ind., Ky., La., Md., Mich., Miss., Mo., N.J., N.Y., N.C., Ohio, Pa., S.C., Tenn., Va.

Palmer (1932) described *Fraxinus profunda* var. *ashei* Palmer, the type from Florida, intending it to represent a glabrous or sparsely pubescent expression of the species. As paratypes, he cited other collections from elsewhere in the range (Georgia, Indiana, Louisiana, Maryland, Missouri, North Carolina, Virginia) that are typical *F. profunda*. The type of var. *ashei*, however, has proved to be a plant of *F. pauciflora* Nutt. (Nesom 2010), and it is possible that other collections have been confused in identification. All collections from Florida, where both species occur in abundance, filed as *F. profunda* should be reexamined to be sure they are correctly identified. The map here (Fig. 1) is based on specimens personally examined as well as some records from literature (as indicated by different symbols).

Leaflets of *Fraxinus profunda* usually are large, characteristically with a rounded base and entire to obscurely serrate margins, and commonly pubescent abaxially at least along midrib and

primary lateral veins, often over the whole surface. Twigs and leaf rachises also usually are pubescent. Leaf scars of *F. profunda* contrast with those of *F. pennsylvanica* in being thinner with a distinctly concave or notched apex. Samaras of *F. profunda* (Fig. 2) are large with thick, wide bodies characteristically dark brown to reddish brown; for smaller-leaved collections, mature fruits may be critical for unambiguous distinction from *F. pennsylvanica*.

1. **Leaflets** (6–)7.5–11(–12) cm long, 2.5–5(–6) cm wide, bases obtuse to acute or abruptly attenuate; **samaras** 20–45(–60) mm long, bodies thickened but not plump, distinctly longitudinally channeled, (12–)15–22 mm long, 1–2 mm wide, tan (similar to wings) to darker brown or rarely reddish-brown, wings arising abruptly from distal 1/4–1/5(–1/2) of body, 4–7(–8) mm wide; fruiting **calyx** 1–1.5 mm long. ..... **Fraxinus pennsylvanica**

1. **Leaflets** (7–)9–15(–25) cm long, (2.5–)3.5–7(–11) cm wide, bases often rounded, less commonly obtuse to acute or acuminate; **samaras** (35–)40–70(–75) mm long, bodies plump, narrowly ridged but not distinctly channeled, (16–)18–30 mm long, 3–4.5 mm wide, dark brown to reddish brown, wings gradually expanded from near the base of the body to proximal 2/3, (5.5–)6–10(–12) mm wide; fruiting **calyx** (1–)4–7 mm long. ..... **Fraxinus profunda**

The chromosome number of *Fraxinus profunda* was reported by Wright (1957) as hexaploid, $2n = 138$. The genome has been hypothesized to be alloploid in origin, derived from a cross between diploid *F. pennsylvanica* and tetraploid *F. americana* (Miller 1955; Wright 1959, 1965), or autoploid from *F. pennsylvanica* (Miller 1955). Hardin and Beckmann (1982), corroborated by Williams and Nesom (2010), showed that the abaxial leaf surface of *F. profunda* is similar to that of *F. pennsylvanica*, without features suggesting an influence of *F. americana*, thus not contradicting an origin through autoploidy. Waldron et al. (1996), however, noted that "The bark on older trees [of *F. profunda*] most commonly develops into solid, continuous ridges similar to those of White Ash and not flaky, broken ridges like those of Red Ash." In the phylogenetic analysis by Wallander (2008), each of three samples of *F. pennsylvanica* appears in a cladistically distinct position on her majority rule consensus tree, and *F. profunda* does not appear as sister to any of the three.

Hardin & Beckmann (1982) noted that very large and asymmetrical scales on the abaxial surfaces is a unique features of *Fraxinus profunda* and provided an SEM photo (their Fig. 23, no voucher cited). I have seen these scales on some collections from Florida, and perhaps they are more common on trees from along the Atlantic coast, but among the specimens I have studied from elsewhere, such scales are rarely present or at least not consistently present.

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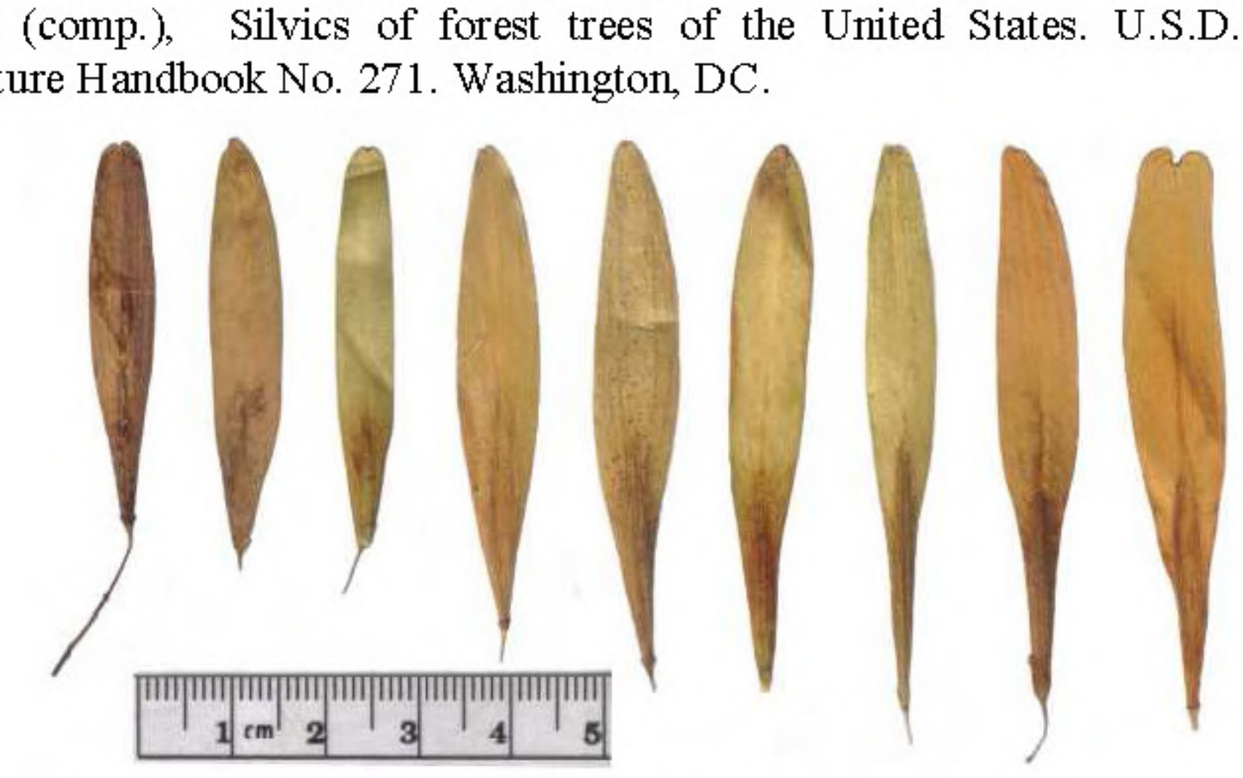

Figure 1. Samara variation in *Fraxinus profunda*.

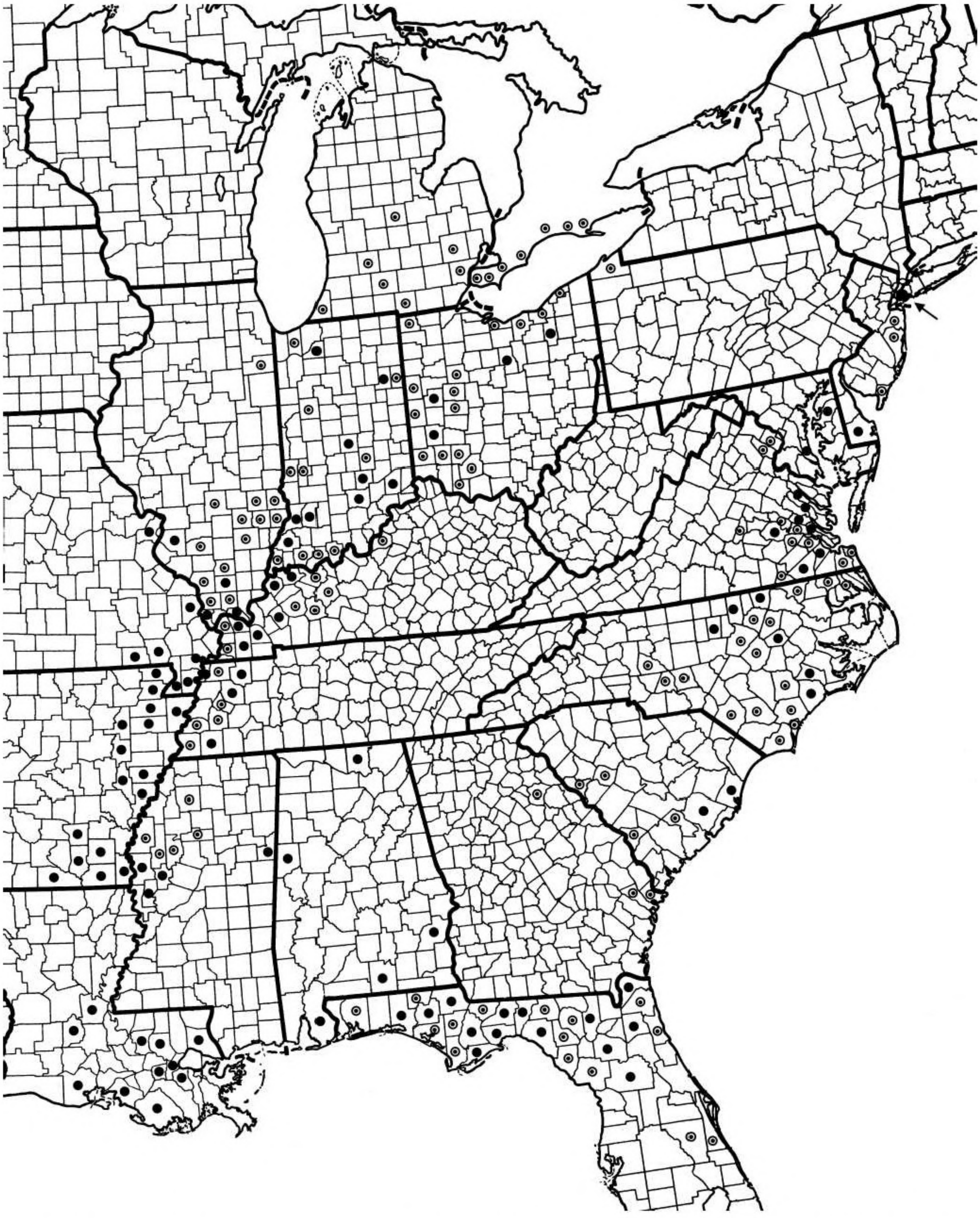

Figure 2. Distribution of *Fraxinus profunda*. Solid circles represent vouchers seen; dotted circles are from literature (as cited in text). The arrow points to Bronx County, New York, the northeastern limit of the species.